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## Review Article

# Different applications of platelet rich fibrin in dentistry: A review

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### ABSTRACT

Platelet rich fibrin contains various growth factors with in it and it is composed of fibrin matrix. Platelet rich fibrin is a concentrate of platelets of the second generation. Platelet rich fibrin helps in reducing the process of inflammation and enhance the healing process. An ideal environment is provided by platelet rich fibrin for the process of wound healing as well as regeneration of the tissue, as they combine the properties of fibrant sealant along with the properties of the growth factors in it. Platelet rich plasma has some advantages as it is derived more easily and with economical method of preparation along with it, it also eliminates the requirement of any exogenous compound for e.g. bovine thrombin or calcium chloride during the process of fabrication.

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## 1. Introduction

There are different biomaterials which has been introduced and used in dentistry to promote the wound healing and enhance the process of inflammation. Different materials like crystals of hydroxyapatite, freeze dried bone graft, tricalcium phosphate or bioactive glass has been used to fill the osseous defects and speeds up the process of healing. Platelet rich fibrin provides osse conductive scaffold along with the different growth factors to simulate the patients own cell towards a regenerative response. The regenerative potential of platelets was introduced in 1970' s, when it is found that the platelet concentrates contains different growth factors that helps in increasing the production of collagen along with the growth of the blood vessels.<sup>1-4</sup>

The major drawback in other bioactive materials used in the process of tissue engineering is that, most of them are avascular in nature therefore they are not able to provide blood supply to the hard or soft tissue for the process of regeneration. Due to the release of various growth factors,

platelet rich fibrin is found to be the key component in the early phase of regeneration. Platelet rich fibrin enhances the process of wound healing as they release different growth factors, adhesion molecules, factors of coagulation, cytokines, and different angiogenic factors that promotes and enhance the proliferation of cells which are involved in the process of wound healing. The use of platelet rich plasma is declined which has been over taken by the use of platelet rich fibrin, as the process of development of platelet rich plasma is quite lengthy and requires the addition of anticoagulants like bovine thrombin or calcium chloride to prevent the clotting of the blood which is collected from the patient. To overcome this disadvantage a second generation platelet concentrate which is known as platelet rich fibrin is developed which requires no additional use of anticoagulant for its preparation along with the ease of preparation with shorter duration of time.<sup>5-7</sup>

The platelet rich plasma was first introduced by the Whitman et al. in the year of 1970's firstly in the oral surgical procedure and found it advantageous as it promotes osteoprogenitor cells in the bone of the host as well as in the bone graft. On the other hand in the year of 2001 platelet

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rich fibrin was first introduced by Choukroun et al and used specifically in the oral and maxillofacial surgeries. Platelet rich fibrin is having different advantages over platelet rich plasma like ease of manipulation, it does not require any chemical for the manipulation of the blood. Platelet rich fibrin is basically a matrix of fibrin in which different growth factors and platelets of cytokines and different cells are trapped within it and is released after some time and they served as a resorbable membrane. After the activation of the growth factors from the platelets entrapped with in the matrix of the fibrin, they have shown enhancing the mitogenic response in the periosteum for the process of bone repair, during the whole process of wound healing.<sup>8,9</sup>

## 2. Preparation of Platelet Rich Fibrin

The risk of trans contamination is totally reduced in the preparation of platelet rich fibrin as it totally prepared as a concept of autologous material and it does not required the addition of any type of anticoagulants in it. Platelet rich fibrin does not alter any type of function of the cell in physiological manner and it also allows to continue the physiological cell functioning even after the process of centrifugation. In the preparation of platelet rich fibrin a total of 10 ml of venous blood is collected from the patient peripheral vein and the collected peripheral venous blood is transferred in to the glass test tube. The protocol for platelet rich fibrin requires only the blood which is centrifuged that too without the addition of any anti-coagulant in to it. After the blood is transferred to the glass tube, tube is centrifuged at 3000 rotation per minute for 10 minutes. If the collected blood is not centrifuged immediately, it results in polymerization of the fibrin which ultimately results in the reduction in the quantity and quality of the clot.<sup>7–11</sup>

After the process of centrifugation, the blood sample in the test tube should left to settle down in to the three separated layers. The three different layers are the top most layer which contains acellular plasma or also known as the plasma which is poor in platelets, the colour of the top most layer is straw colored. After this layer the second layer or the intermediate layer is of the platelet rich fibrin clot which is highly rich in fibrin and includes different factors of growth as well as cytokines that too in the polymerized structure, the bottom most layer or the third layer is red in colour and consists only erythrocytes. The blood underwent intrinsic coagulation when it contacts the glass tube, which results in segregation of blood in to clot and plasma. During the process of centrifugation fibrinogen that are present in the fraction of the plasma combines with the thrombin and ultimately results in the formation of the region of platelet rich fibrin in between the plasma which is acellular and lower packed rbc rich fraction. While retrieving the platelet rich fibrin the top most layer of acellular fraction is removed and the middle platelet rich fibrin fraction is collected with the help of the forcep or plier along with the bottom most

layer of the attached erythrocytes from the test tube. After than the fibrin clot containing the platelet rich fibrin is placed over a sterile gauze piece and the bottom most layer of erythrocytes are scrapped off.<sup>12–15</sup>

Platelet rich fibrin exudates contains good amount of growth factors like TGF- $\beta$ 1, PDGF-AB, VEGF, glycol proteins like fibronectin, vitronectin and various sroteins that helps in cell attachment to different bio materials and titanium.

## 3. Different Uses of Platelet Rich Fibrin

1. Ease of fabrication.
2. Cost friendly, or economical to the dentist.
3. Reduces chances of cross infection as there is no use of anticoagulant in it.
4. Formation of physiological thrombin concentration, because of the process of natural polymerization of the platelet rich fibrin as or when it contacts the glass particle of the test tube.
5. The protocols used for the fabrication of platelet rich fibrin is standardized.
6. Helps in hemostasis, as the matrix of platelet rich fibrin provides the property of elasticity and flexibility both to the matrix.
7. Enhance the healing rate of the bone which is grafted in the osseous defect.
8. Reduce Patient discomfort.
9. Reduce chances of post-surgical infection.

## 4. Disadvantages of Platelet Rich Fibrin

1. As it is autologous blood the final amount of the platelet rich fibrin achieved is low.
2. The success of the platelet rich fibrin is totally dependent over the handling of the fibrin clot.
3. Specific glass coated tube is required for the process of polymerization.

## 5. Uses of Platelet Rich Fibrin in Dentistry

1. Platelet rich fibrin can be used in the treatment of the periodontal bone defects, it also helps in the reduction of the probing depth.
2. Platelet rich fibrin can also be used in the treatment of the local osteitis, literature stated that there is 90 percent reduction of the osteitis in the third molar surgical site.
3. Platelet rich fibrin helps in maintaining the alveolar ridge height after multiple extraction.
4. Platelet rich fibrin has the capacity of pulp revascularization, because platelet rich fibrin is quite rich in various growth factors.
5. Platelet rich fibrin helps in regeneration of the bone in cases of immediately placed implants.

6. Platelet rich fibrin helps in the process of root coverage.
7. Platelet rich fibrin helps in the process of periodontal regeneration.
8. Platelet rich fibrin used in the guided tissue regeneration procedure as well as in guided bone regeneration procedure.
9. Studies have shown that there is improved osseous growth when platelet rich fibrin membrane is used in intra bony defects.<sup>9–15</sup>

## 6. Conclusion

Literature revealed promising results with the usage of the platelet rich fibrin membrane that too without any contradictory measure. Only precaution should be taken while handling the platelet rich fibrin membrane.

## 7. Source of Funding

None.

## 8. Conflict of Interest

None.

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